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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,983	06/24/2003	Naoya Hasegawa	9281/4588	3871
7590	12/15/2004			
Brinks Hofer Gilson & Lione P.O. Box 10395 Chicago, IL 60610			EXAMINER BERNATZ, KEVIN M	
			ART UNIT 1773	PAPER NUMBER

DATE MAILED: 12/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/603,983

Applicant(s)

HASEGAWA ET AL.

Examiner

Kevin M Bernatz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13,15-28 and 30 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-13,15-28 and 30 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>6/24/03</u> . | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Response to Amendment

1. Cancellation of claims 14, 29 and 31 - 48, filed on October 13, 2004, have been entered in the above-identified application.

Election/Restrictions

2. Applicant's election of species B in the reply filed on October 13, 2004 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). However, the Examiner notes that since the nonelected claims have been cancelled, the election is now rendered moot.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claims 8 – 13 and 15 – 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
5. Claim 8 recites language which the fails to particularly point out and distinctly claim the subject matter. Specifically, applicants have not defined in the claims what is intended to represent the "track-width region" and it is unclear if "a film thickness of the

free magnetic layer in a track-width region" means the thickness (height?) of the layer perpendicular to the track-width direction, or the thickness (width?) of the layer lying along the track-width direction?

6. Claims 9, 10, 13 contain similar indistinct language with regard to both the "track-width region" and the "film thickness"
7. Claims 11, 12, 15 - 17 contain similar indistinct language with regard to the "track-width region"
8. Claims 18 – 22 recites the language "wherein a pair of the second antiferromagnetic layers having a spacing are provided on the second free magnetic layer with a third antiferromagnetic layer therebetween". It is unclear whether applicants intend to claim an embodiment wherein the third antiferromagnetic layer is between the "pair of second antiferromagnetic layers", or whether applicants are attempting to claim an embodiment wherein the third antiferromagnetic layer is located between the second antiferromagnetic layer and the second free magnetic layer.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States

only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 1 – 7 are rejected under 35 U.S.C. 102(a) and 102(e) as being anticipated by anticipated (U.S. Patent App. No. 2003/0103299 A1).

Regarding claim 1, Saito discloses a magnetic sensing element (*Title*) comprising a multilayer film including a first antiferromagnetic (AFM) layer (*Figure 6, element 29*), a pinned magnetic layer (*element 28*), a non-magnetic material layer (*element 27*) and a free magnetic layer (*element 38*) in that order from the bottom, wherein the free magnetic layer comprises a first free magnetic layer having a predetermined dimension in a track-width direction (*element 37*) and a second free magnetic layer (*element 35*) which is provided on the first free magnetic layer and which has a dimension in the track-width direction larger than that of the first free magnetic layer, a second AFM layer for aligning a magnetization direction of the free magnetic layer in one direction is provided as a layer above the second free magnetic layer (*element 23*), and a pair of electrode layers are provided on both side portions of the multilayer film (*elements 20 and 31*).

Regarding claim 2, Saito discloses embodiments meeting applicants' claimed limitations (*Figure 9, element 26*)

Regarding claims 3 - 5, Saito discloses a non-magnetic intermediate layer between the first and second free magnetic layers (*Figure 6, element 36*) meeting applicants' claimed material limitations (*Paragraph 0224*).

Regarding claims 6 and 7, Saito discloses track widths meeting applicants' claimed limitations (*Paragraph 0246*).

11. Claims 1 – 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Hoshiya et al. (U.S. Patent App. No. 2003/0206384 A1).

Regarding claim 1, Hoshiya et al. disclose a magnetic sensing element (*Title*) comprising a multilayer film including a first antiferromagnetic (AFM) layer (*Figure 22, element 11*), a pinned magnetic layer (*element 15*), a non-magnetic material layer (*element 121*) and a free magnetic layer (*element 13*) in that order from the bottom, wherein the free magnetic layer comprises a first free magnetic layer having a predetermined dimension in a track-width direction (*element 133*) and a second free magnetic layer (*element 134 and 412*) which is provided on the first free magnetic layer and which has a dimension in the track-width direction larger than that of the first free magnetic layer, a second AFM layer for aligning a magnetization direction of the free magnetic layer in one direction is provided as a layer above the second free magnetic layer (*element 413*), and a pair of electrode layers are provided on both side portions of the multilayer film (*elements 35 and 36*). See also Figure 2, element 40 and Figure 22, element 73 and Paragraphs 0056 and 0101, which teach using electrodes directly deposited on the side faces of the multilayered film for a Current-in-plane (CiP) configuration of a MR head versus a CPP configuration wherein the electrodes extend across both the track width and the side portions of the multilayered film.

Regarding claim 2, Hoshiya et al. disclose embodiments meeting applicants' claimed limitations (*Figure 22, elements 133 and 134*)

Regarding claims 3 - 5, Hoshiya et al. disclose a non-magnetic intermediate layer between the first and second free magnetic layers (*Figure 22, elements 133, 411 and 412*) meeting applicants' claimed material limitations (*Paragraph 0099*).

Regarding claims 6 and 7, Hoshiya et al. disclose track widths meeting applicants' claimed limitations (*Paragraph 0076*).

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claims 23 – 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoshiya et al. as applied above, and further in view of Mack et al. (U.S. Patent No. 6,462,919 B1).

Hoshiya et al. is relied upon as described above.

Regarding claim 23, Hoshiya et al. fail to disclose a pair of second AFM layers meeting applicants' claimed structural limitations.

However, Mack et al. teach that using a biasing structure to provide longitudinal biasing to the free magnetic layer end regions outside the track-width dimensions (see *Figure 6A*) comprising a pair of second AFM separated by a space in the track-width direction (*Figure 6B, elements 222B and 224B*) can stabilize the free layer against the formation of edge domain walls without the problems with a permanent abutted junction

across the entire surface of the free layer, as shown in Hoshiya et al., Figure 22 (*Mack et al.*, col. 2, lines 15 – 56; col. 4, line 21 bridging col. 5, line 17; and col. 8, line 22 bridging col. 9, line 12).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hoshiya et al. to include a biasing structure meeting applicants' claimed limitations as taught by Mack et al. to stabilize the free layer against the formation of edge domain walls without the problems with a permanent abutted junction across the entire surface of the free layer.

Regarding claim 24, the Examiner notes that these limitation(s) are/(is a) process limitation(s) and is/are not further limiting in terms of the structure resulting from the claimed process. Specifically, in a product claim, as long as the prior art product meets the claimed structural limitations, the method by which the product is formed is not germane to the determination of patentability of the product unless an unobvious difference can be shown to result from the claimed process limitations. In the instant case, the Examiner notes that the films are formed successively.

Regarding claim 25, the Examiner notes that applicants are claims $(t_{\text{ferro}} + t_{2\text{nd}}) < (t_{1\text{st}} + t_{2\text{nd}})$, or $t_{\text{ferro}} < t_{1\text{st}}$. However, Mack et al. disclose ferromagnetic layers of $\sim 20 \text{ \AA}$ thickness (2 nm) (col. 8, lines 58 – 64) and Hoshiya et al. disclose first free magnetic layers of twice this size (examples; e.g. Paragraph 0090 – “NiFe 4 nm thick as the first free layer soft magnetic film”). The Examiner deems that even though neither Mack et al. nor Hoshiya et al. explicitly disclose either the claimed mathematical relationship or an explicit embodiment meeting the claimed structure + thickness limitations, that one of

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ordinary skill in the art would have been readily appraised of the relative thickness values of the various layers to use thickness values meeting applicants' claimed relationship limitations.

Regarding claims 26 and 27, Mack et al. disclose a non-magnetic intermediate layer meeting applicants' claimed structural and material limitations (*Figure 6B, layer 230B and col. 8, line 34 bridging col. 9, line 12*).

14. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoshiya et al. in view of Mack et al. as applied above, and further in view of Li et al. (U.S. Patent App. No. 2003/0156361 A1).

Hoshiya et al. and Mack et al. are relied upon as described above.

Neither of the above disclose using Cr as the non-magnetic intermediate layer between the second free magnetic layer and the ferromagnetic layer.

However, the Examiner deems that Ru and Cr are known equivalents in obtaining a synthetic antiferromagnet with antiferromagnetic coupling between the adjacent magnetic layers, as taught by Li et al. (*Paragraphs 0034, 0035 and 0054*).

Substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. In the instant case, Ru and Cr are equivalents in the field of non-magnetic materials useable in a synthetic antiferromagnetic structure. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

15. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoshiya et al. in view of Mack et al. as applied above, and further in view of Song et al. (U.S. Patent No. 6,795,280 B1).

Hoshiya et al. and Mack et al. are relied upon as described above.

While Mack et al. disclose the claimed spacing being equal to the dimension of the first free magnetic layer, neither Hoshiya et al. or Mack et al. disclose the spacing in the track-width direction between the pair of second AFM layers being larger than the dimension in the track-width direction of the first free magnetic layer.

However, Song et al. teach a similar structure resulting from the combination of Hoshiya et al. with Mack et al., i.e. a first and second free magnetic layers (*Figure 4D, layers 512 and 542*) meeting the claimed relative dimensions combined with two biasing elements/exchange tabs separated by a space in the track-width direction ("*P.M*" *elements and col. 5, lines 32 – 36*). Song et al. clearly teach the preferred location of the biasing elements for providing horizontal bias to the free magnetic layer should be placed such that the space between the biasing elements is wider in the track-width direction than the width of the first free magnetic layer (*element 512*) in the track-width direction.

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hoshiya et al. in view of Mack et al. to use a pair of second antiferromagnetic layers meeting applicants' claimed structural limitations as taught by Song et al., since Song et al. teaches a preferred structure comprising exchange tabs meeting applicants' claimed structural limitations for use

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above a magnetic head explicitly meeting the claimed relative first and second free magnetic layer dimensions.

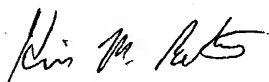
Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ho et al. (U.S. Patent No. 6,754,056 B2) teaches or renders obvious at least claims 1 and 2 (see *Figure 13*). No art rejection has been made due to the similarity with the already relied upon prior art documents.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Deborah Jones can be reached on (571) 272-1535. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Kevin M. Bernatz, PhD.
Primary Examiner

December 10, 2004